Ruffin B. Cordell (Admission *Pro Hac Vice*)
cordell@fr.com
Joseph V. Colaianni (Admission *Pro Hac Vice*)
colaianni@fr.com
Peter J. Sawert (Admission *Pro Hac Vice*)
sawert@fr.com
FISH & RICHARDSON P.C.
1425 K Street NW, 11th Floor
Washington, DC 20008
Telephone: 202-783-5070 / Facsimile: 202-783-2331

Michael A. Amon, SBN 226221
amon@fr.com
Michael M. Rosen, SBN 230964
rosen@fr.com
Olga I. May, SBN 232012
omay@fr.com
FISH & RICHARDSON P.C.
12390 El Camino Real
San Diego, CA 92130-2081
Telephone: 858-678-5070 / Facsimile: 858-678-5099

Attorneys for Defendants, Cox Communications, Inc.; XO Communications Services, LLC; Global Crossing Telecommunications, Inc.; Level 3 Communications LLC; 360networks (USA) inc.; Electric Lightwave, LLC, dba Integra Telecom; IXC Holdings, Inc. dba Telekenex; and Infinera Corporation

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA, SOUTHERN DIVISION

CAMBRIAN SCIENCE CORPORATION, a California corporation,

Plaintiff,

v.

COX COMMUNICATIONS, INC., a Delaware corporation; XO COMMUNICATIONS SERVICES, LLC, a Delaware limited liability company; GLOBAL CROSSING TELECOMMUNICATIONS, INC., a Michigan corporation; LEVEL 3 COMMUNICATIONS LLC, a Delaware limited liability company; 360NETWORKS (USA), INC., a Nevada corporation; ELECTRIC LIGHTWAVE, LLC, dba INTEGRA TELECOM, a Delaware limited liability company; IXC HOLDINGS, INC. dba TELEKENEX, a Delaware corporation; and INFINERA CORPORATION, a Delaware corporation,

Defendants.

AND RELATED COUNTER CLAIMS.

Case No. 8:11-CV-01011-JST (AN)

DECLARATION OF DR. THOMAS L. KOCH

Hon. Josephine Staton Tucker

I, Thomas L. Koch declare as follows:

1. I have personal knowledge of the matters stated in this Declaration and would testify truthfully to them if called upon to do so.

2. I am presently the Dean of the College of Optical Sciences at the University of Arizona. I have attached a copy of my *curriculum vitae*, which further details my education and my professional experience in the field of optics to this declaration.

3. I have been retained by counsel for the Defendants to offer my opinions regarding the technology relevant to U.S. Patent No. 6,775,312 ("the '312 patent") and the understanding of certain claim language of the '312 patent to persons having ordinary skill in the art at the time the '312 patent was filed. To this end, I have aided counsel for the Defendants in understanding the general technology relating to the '312 patent and in formulating the Defendants' proposed claim constructions.

4. I submitted a declaration on April 15, 2012 that set forth my opinions regarding the understanding of certain claim language that was at that time disputed by the parties. I understand that since the submission of my April 15 declaration, the Plaintiff and Defendants have met and conferred regarding proposed claim constructions and have agreed upon a number of definitions for previously disputed claim terms. This declaration sets forth my opinions with respect to the claim terms that remain in dispute between the parties.

5. I understand that I may be asked to offer testimony regarding the general technological field of the '312 patent, the proper understanding of a person having ordinary skill in the art of the claim language identified by the parties for construction, Defendants' proposed constructions, and the constructions proposed by Plaintiff Cambrian Science Corporation, in order to assist the Court in its role of determining the meaning of the claim language in dispute.

6. I also understand that the primary evidence upon which the Court must rely for determining the meaning of a claim term is called the intrinsic evidence. The intrinsic evidence includes the claim language itself, the patent specification, and the

prosecution history of the patent. The claims themselves are of primary importance but are read in the context of the entire patent, including the other claims and the specification. The prosecution history may further illuminate the meaning of claim language by disclosing how the inventor understood the claims during prosecution.

7. I understand that the Court can only consider additional, extrinsic evidence, if the meaning of a claim term cannot be determined from the intrinsic evidence alone. Examples of extrinsic evidence are dictionaries, technical references, and expert testimony.

8. Based on my review of the '312 patent and my experience, I believe that a person having ordinary skill in the art would be a person with an undergraduate or master's degree in physics or electrical engineering with 3-5 years of experience working in the field of active semiconductor guided wave optoelectronics, including, for example, semiconductor laser technology or semiconductor optical amplifier technology, or a person with a doctorate degree in physics or electrical engineering with at least 1-2 years of experience working in the field of active semiconductor guided wave optoelectronics, including, for example, semiconductor laser technology or semiconductor optical amplifier technology.

9. I was informed that the parties dispute the interpretation of certain claim language and intend to ask the Court to interpret this language. I assisted counsel for Defendants in providing proposed constructions for this disputed language.

10. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the related terms "active waveguide coupler" and "active coupler" to mean "optical component (1) formed of active material that is pumped to produce gain (2) that also combines light from multiple sources." My opinion finds support in and is consistent with the intrinsic evidence, including the '312 patent at Col. 1:33-43, 2:14-31, 5:44-50, 6:63-7:15, 7:21-31, 7:62-64, 8:7-23, 9:9-27, 9:36-55, Fig. 4, Fig. 5, Fig. 9, Fig. 11, and Fig. 12.

11. I also understand that Plaintiff and Defendants have identified "active region" as a separate disputed claim term requiring construction. I have assisted counsel for Defendants in providing a proposed construction for the disputed language. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of this its filing would have understood the term "active region" to mean "a region in which the absorption of an optical signal can be changed to gain by application of pumping." My opinion finds support in and is consistent with the intrinsic record, including but not limited to the '312 patent at Col. 2:21-24, 29-31, 6:17-23, 28-62, 7:62-64, 8:1-12, 9:43-45, 11:46-49.

12. I understand that the Plaintiff and Defendants have agreed to shorten the terms addressed in paragraph 15 of my prior declaration to "high output power combining of the outputs of the laser array" and "power combining the outputs of the individual ones of the laser elements of the laser array" and agreed that both terms should have the same construction. In light of that agreement and the surrounding claim language, it is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood these terms to mean "(1) pumping the active material of the coupler to produce gain to the light signals input to the coupler (2) while combining the light from multiple lasers in a manner that does not depend on the laser wavelengths." My opinion finds support in and is consistent with the intrinsic evidence, including but not limited to the '312 patent at Col. 1:33-2:3, 2:14-31, 2:63-66, 5:44-50, 6:63-7:15, 7:21-31, 7:62-64, 8:7-23, 9:9-27, 9:36-55, Fig. 4, Fig. 5, Fig. 9, Fig. 11, and Fig. 12.

13. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the related terms "semiconductor optical amplifier" and "SOA" to mean "optical component, distinct from lasers and couplers, formed of active material that is pumped to produce gain." My opinion finds support in and is consistent with the intrinsic evidence, including

but not limited to the '312 patent at Col. 2:14-19, 5:37-41, 5:45-50, 6:26-51, 7:13-15, 7:21-31, and 9:18-65.

14. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the related terms "formed using substantially the same vertical structures," "formed from substantially the same vertical structures," "formed substantially from the same vertical semiconductor material structure," and "formed from substantially the same vertical semiconductor structure" to mean "consisting of essentially the same materials in continuous layers of essentially the same thickness in essentially the same vertical order." My opinion finds support in and is consistent with the intrinsic evidence, including but not limited to the '312 patent at Col. 2:29-40, 6:63-7:15, 7:21-31, 8:63-9:5, and Fig. 4.

15. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the related terms "gain of the active coupler," "gain of the coupler," and "wherein the coupler has a gain" to mean "an output power greater than the input power of the coupler due to pumping of the active material." My opinion finds support in and is consistent with the intrinsic evidence, including but not limited to the '312 patent at Col. 5:38-50, 6:59-62, 7:62-64, and 8:7-23.

16. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the term "substantially all of the photonic integrated circuit" to mean "all or essentially all of the photonic integrated circuit." An example of support would be definition b.4 of substantially in the Oxford English Dictionary, 2nd edition (1989).

17. I have also determined that it would be helpful to clarify the construction I previously described for "heater element." It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the term "heater element" to mean "heat control component." My

opinion finds support in and is consistent with the intrinsic record, including but not limited to the '312 patent at Col. 12:36-65 and claim 35.

18. It is my opinion that, in the context of the '312 Patent, a person of ordinary skill in the art at the time of its filing would have understood the term "mitigate reflection of light" to mean "significantly reduce the amount of light reflected back into the photonic integrated circuit from the cleavage edges." My opinion finds support in and is consistent with the intrinsic evidence, including but not limited to the '312 patent at Col. 4:26-29 and 10:11-44.

19. I understand that the parties continue to meet and confer and are working to finalize their proposed constructions of the disputed claim language. If asked to do so, I may also form opinions and offer testimony relating to Cambrian's final proposed constructions of the above-identified claim language.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct, to the best of my knowledge.

Executed this 6th day of May, 2012 in San Jose, California.

/s/ Thomas L. Koch
Thomas L. Koch

THOMAS L. KOCH

Office:

College of Optical Sciences
University of Arizona
1630 E University Blvd. Rm 702
P.O. Box 210094
Tucson, AZ 85721-0094
Tel. (520)-621-2448
Email: tlkoch@optics.arizona.edu

Home:

13795 E Redington Rd
Tucson, AZ 85749
Email: tlkoch@att.net

EDUCATION

CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, California
Ph.D. in Applied Physics, June 1982.
Thesis Advisor: Professor Amnon Yariv

Honors:
National Science Foundation Graduate Fellow, 1978-1981.
ARCS Foundation Scholarship Awards, 1979,1980,1981,1982.
Earl C. Anthony Fellowship, 1977-1978.

PRINCETON UNIVERSITY, Princeton, New Jersey
A. B. degree in Physics, June 1977.

Honors:
Kusaka Memorial Prize in Physics
Graduation Magna Cum Laude

EXPERIENCE

Dean, College of Optical Sciences
Professor of Optical Sciences
University of Arizona 2012 *to present*

Responsible to advance educational, research, and outreach mission of the College of Optical Sciences at the University of Arizona, the largest undergraduate and graduate optics, education and research program in the nation.

Director, Center for Optical Technologies
Daniel E. '39 and Patricia M. Smith Endowed Chair
Joint Prof. of Electrical & Computer Engineering and Physics
Lehigh University 2003 - 2011

Responsible to lead COT, including definition, incubation, and funding for new multidisciplinary research initiatives and facilities investments. Principal Investigator on State and Federal contracts for Center and personal research totaling in excess of $36M. COT succeeded in providing the critical infrastructure and collaborative environment required for new tenure track faculty in multidisciplinary university focus areas to launch prolific, internationally-recognized research programs and establish sustainable funding channels. Chaired numerous faculty and administrative search committees, worked with participating academic departments to seize opportunities for new collaborative research programs, and launched COT industry/government initiatives and new educational outreach activities. Personal teaching responsibilities include a new two-semester Optoelectronic Physics & Lightwave Technology I & II course; developed externally funded research programs in silicon photonics, biophotonics, and high capacity optical communications. Supervised 3 Ph.D. students, 4 MS students, 3 Post-Doctoral research associates.

Vice President, Technology Platforms
Agere Systems/Lucent Technologies, Breinigsville, PA 2000 - 2003

Managed Agere's core optoelectronics and IC device technology platform R&D through a very dynamic period including the telecommunications boom, the spin of Agere Systems from Lucent Technologies, and the following dramatic market decline. As VP was responsible to select

investment areas and create a highly productive environment for a staff of 200-300 researchers and developers with an annual budget of $60-80M. Specifically responsible for execution of all R&D programs in underlying (non-product specific) materials, device, packaging, and subsystems technologies, and also to provide substantial product-specific and prototyping support. Developed vital research team engagement in the international academic and industrial research community as essential process in identifying breakthroughs and new technology opportunities. Introduced new formal technology and platform roadmap methodologies to feed longer term product research and development, including new management processes to drive efficient and optimized budget and organizational alignment. Worked closely with Optoelectronics Executive VP during launch of Agere in defining strategy for product/technology portfolio, M&A and ongoing joint development activities, and occasional interfacing with the external investment community. During formation of Agere, this role also included extraction of critical optoelectronics staffing from Bell Labs Research to support Agere's mission, and detailed technical oversight of Bell Lab's opto IP portfolio split with Lucent. Also included substantial role, reporting to Agere's Infrastructure Executive VP, in enabling the successful sale of Agere's Optoelectronics business in the face of the dramatic market downturn.

Chief Technical Officer, Optoelectronics Products
Director, Semiconductor Photonics Research Department
Bell Laboratories, Lucent Technologies
Holmdel and Murray Hill, New Jersey; Breinigsville, Pennsylvania 1996 -1999

Responsible to lead Bell Lab's multi-location research activities in semiconductor photonics (50-60 MTS & consultants). Research activities encompassed III-V optoelectronics: lasers, detectors, modulators, amplifiers, photonic integrated circuits, associated microfabrication technologies, and advanced optoelectronic subsystems. Management oversight included substantial facilities consolidations and construction while maintaining full operation of microfabrication capabilities, including extensive multi-location III-V epitaxy and clean room facilities, comprehensive materials and device characterization facilities, Bell Lab's direct-write e-beam lithography facilities, and major device and process modeling/theory programs. As member of Senior Leadership Team of the Optoelectronics Products Business Unit, provided guidance in selecting new technology opportunities, product definition and manufacturing platforms. Managed joint Research/Business Unit activities to accelerate new product time to market and best-in-class platform capability. Enable low-volume sampling of new component/subsystem functionality to Lucent's Systems Research, Optical Network Group, and Optoelectronics Products customers.

Vice President, Research and Development
SDL, Inc., San Jose, California 1995 -1996

Responsible to lead SDL's research and development activities in semiconductor lasers (~40 staff members). Responsibilities included new product definition, and securing and executing research contracts with government and private sector customers as primary funding vehicle for SDL's research. Managed SDL's R&D over a broad range of technologies, including high-power pumps, novel diffraction-limited high-power sources, red & blue visible lasers, both frequency-doubling modules and GaN/InGaN, and numerous specialty material and device contracts.

Head, Supervisor, and MTS, Photonic Circuits/Electronic Device Research Departments
Electronics/Photonics Research Laboratories, Bell Labs, Holmdel 1982 -1995

Responsible to lead Department (13-16 MTS, 9-15 PMTS, visitors, consultants) in research and prototyping of lasers and advanced photonic devices for optical communications. Activities included III-V lasers and optoelectronics, first generation of photonic integrated circuits, high-speed III-V electronics, and microfabrication technology. Extensive evaluation of tunable coherent and WDM sources, expanded-beam lasers, wavelength conversion technologies, and semiconductor amplifiers. Department maintained full microfab capabilities including Bell Lab's direct-write e-beam facilities, extensive III-V growth, and high-speed characterization facilities. Responsibilities also include shared management of divisional clean room facility. Earlier personal research activities as MTS centered on design, fabrication, device and system modeling of InP/InGaAsP optoelectronic devices with particular emphasis on dynamic and spectral properties of single longitudinal mode semiconductor lasers.

AWARDS & ACTIVITIES

IEEE Eric E. Sumner Award, 2008
Elected into National Academy of Engineering, 2007
Fellow, Bell Labs, 1998
Fellow, IEEE, 1995
Fellow, Optical Society of America, 1991
IEEE/LEOS William Streifer Scientific Achievement Award, 1991
Distinguished Lecturer Award for IEEE Lasers and Electro-Optics Society, 1990-91
Bell Laboratories President's Gold Award, MONET Network Element Team, 1999

Advisory Board Roles: Serving or served on Board of Directors or Technical Advisory Board of eight international research institutes and/or private companies.

Society, Journal, & Other Service:
Board of Directors, Optical Society of America, 2010-2012.
Vice President, Technical Affairs, IEEE Photonics Socidety, 2011-
Vice Chair, Section 7, Electronics, Communication and Information Systems Engineering, National Academy of Engineering
National Academy of Engineering Section 7 Peer Committee, 2009-2011
National Academies Panel on Digitization and Communications Science, 2009-2012.
Marconi Prize Selection Committee for Marconi Foundation, 2006-2009.
OSA Audit Committee, 2010-2012
Chaired & Participated in numerous Awards Committees for OSA and IEEE.
Co-Chair, ACP Steering Committee, 2009-2010.
Chair, AOE Steering Committee 2007-2008.
OFC Steering Committee, 1997-2003.
Vice President of Finance and Administration, 1993-94, Elected Member of Board of Governors, 1991-1993, IEEE Lasers and Electro-Optics Society.
Chair (93-94) and member (1990-92, 95) of Semiconductor Laser Subcommittee, IEEE/LEOS.
Associate Editor, IEEE J. Quantum Electron., 2003-2005; Guest Co-Editor for IEEE J. Quantum Electron. Special Issue on Semiconductor Lasers, June 1992
Optoelectronics Technical Group Chair, OSA, 1992-94.

Major Conference Chair Positions: General Chair IPR 2011, Program Co-Chair, IPR 2010, Co-Chair, Group IV Photonics 2009, General Chair, AOE 2007, General Chair, OFC2000, General Chair, 2000 IEEE International Semiconductor Laser Conference, Program Chair, OFC'98, Program Chair, 1998 IEEE International Semiconductor Laser Conference, General Chair, 1997 IEEE/LEOS Annual Meeting, Program Chair, 1995 IEEE/LEOS Annual Meeting, Co-Chair 1995 IEEE/OSA Topical Meeting on Semiconductor Lasers: Advanced Devices & Applications, Co-Chair, 1994 IEEE/LEOS Summer Topical on Integrated Optoelectronics

Program Committees: CLEO 2007-2009, 1988-1994, Group IV Photonics 2007, IEEE Int. Semicond. Laser Conf., '08,'06,'04,'96,'94,'92,'90 (Amer. Subcom. Chair 94, 96), IPRM '09, '08, OECC2000, OFC 1990-1992, Integrated Photonics Research, Subcom. Chair 1993, member 1990-1992, IEDM'89, IEDM'90, , InP & Relat. Comp., OSA Annual Meetings, 1987 OSA Top. Meet. on Sem icond. Lasers, IEEE/LEOS Annual Meeting, subcom. chair, '93, member '94.

Workshop Chair Positions: Chair, NSF Workshop on VLSPI, 2007, Co-Chair, Workshop on Silicon Photonics at OFC 2005, Co-Chair, Workshop on WDM Subsystem Tech.. at OFC '94, Co-Chair Workshop on Lasers for WDM Optical Communications at XIV IEEE Int. Semicon. Laser Conf., Chair for '92 IEEE Workshop on Semicond. Lasers, twice chaired sessions at IEEE Workshop on Semicond. Lasers; chaired evening session at XI IEEE Int. Semicon. Laser Conf.

PUBLICATIONS & PATENTS

36 Patents issued; more than 330 combined journal papers and conference presentations, including, 7 plenary and 27 invited conference papers, 6 tutorials, 9 short courses and 3 invited journal papers. Co-edited 2 book volumes, authored or co-authored 4 book chapters.

REFERENCES & PUBLICATIONS LIST – Available upon request